As discussed earlier, the developmental processes of settlements and transportation networks are intertwined to such an extent that it is difficult to isolate factors influencing one but not the other. But since it has been stated that major transportation routes connect larger places, while lesser routes serve smaller places (Morrill 1974:132), the following chart presents hypothesized relationships between settlement types and transportation routes.

	Water				Surface			Railroad			
Settlement Type	Trans-Ocean	Coastal	River	Canal	Inter-Region	Intra-Region	Local Access		Intra-Region	Spurs	Trolley
Homestead	.	.	+	.	+	+	*	.	.	-	-
Hamlet	.	.	+	.	?	+	*	.	.	?	-
Village	.	?	+	+	?	*	+	.	+	+	-
Town	?	+	+	+	+	*	+	+	*	+	-
Frontier Town	*	+	+	+	*	+	+	-	-	-	-
City (M & I)	*	+	*	+	*	+	+	*	+	+	+

. Located near, but ability to take advantage of is questionable
* Highly probable
+ Probable
? Questionable
- Not probable
(Intersections of one type with another and crossroads increase probability.)

FACTORS AFFECTING SETTLEMENT DEVELOPMENT

The several factors previously mentioned as important in influencing settlement pattern are also influential in settlement development.

1. Economics - Of primary concern for settlement development is the

influence of economic competition and the ability of a settlement to maintain its place within the competitive economic system. If there are too many economic losses to competitors elsewhere, a settlement will lose resident workers and businesses, and will eventually decline in importance. If, however, the settlement is able to continue to succeed over its competitors, it will grow and may assume the economic position of one of its competitors.

2. Transportation System - In general, the higher the Transportation Route rank (1 being high) between two settlements, the larger the amount of interaction (socio-economic) between them (Morrill 1974:132). Thus if a settlement is situated on a minor ranked route, it will not be able to increase in importance (economic, social, political) unless or until the route is modified. The route, in this case, retards settlement development, even if other factors are very favorable, since the means of interaction (the route) is insufficient to manage the amount of interaction (be it individuals wishing to visit, or produce needing to get to market). Settlement development would not long be hindered, however, since various economic, political, and social pressures would influence route rank modification. Changes in transportation route location are extremely important in settlement development. For example, when the railroad was built south through the Delmarva Peninsula, it bypassed the thriving riverport of Odessa, going instead through Middletown. As a result of losing this more efficient means of inter-settlement interaction, Odessa's development declined, while Middletown benefited from the increased inter-settlement interaction and its development increased.

3. Geography - Probably the most important geographical factor is the

presence or absence of energy and raw material and resources for economic production. The presence of such resources would encourage settlement; while the absence of such resources would not necessarily discourage settlement, such settlement would tend to be smaller and less important economically. Localized geographical features, such as marshes, steep slopes and river banks, will tend to influence the direction of settlement growth.

4. Population Size - Population size is a crucial factor influencing settlement development. If a settlement is able to absorb increasing population economically and socially, in terms of jobs and housing, the settlement will grow spatially and will increase in settlement density. As a consequence, internal settlement patterning changes through time. Should a settlement not be able to absorb its increasing population, migration will occur to other settlements which can absorb it. This tends to result in an increase in interaction between these two settlements due to kinship maintaining social and business relationships.

5. Technological Innovations - Technological innovations specifically in terms of transportation are very influential in settlement development. Technological innovations that increase the efficiency of interaction within and between settlements (e.g., transportation innovations) will tend to result in changes in settlement development. The introduction of the railroad into Wilmington, for example, rejuvenated the City, which had been suffering severe economic decline (Hoffecker 1974:17), while the city trolley network constructed in the 1860s permitted city growth to expand by affording workers the means to travel to their jobs.

6. Social Concerns - Social concerns are also influential in settlement development, although perhaps in minor ways. As an example, the

desire in the late 19th century for recreational beach resorts either revitalized small beach hamlets or villages, or new resort settlements were founded. Internal settlement pattern is affected by such social factors as ethnicity and social status, manifested in neighborhoods and ghettos.

APPLICATION OF LOCATION AND SETTLEMENT DEVELOPMENT MODELS

A. Data Required

The data required to utilize the location model and to test the settlement development mode fall into two categories: (1) documentary, and (2) archaeological. The two data sets must be used in conjunction to provide one data base. The first provides data on spatial distribution of settlements through the examination of such historic records as maps, tax rolls, and census lists. The second provides more detailed information on internal settlement-patterning, land use, and material correlates of human behavior.

B. DelDOT Projects

Six DelDOT archaeological projects provide the majority of data for applying the models. These are:

1. Wilmington Boulevard (Cunningham et. al. 1984)
2. Rt. 4 Schoolhouse (Catts et. al. 1983)
3. Wilson-Slack Agricultural Complex (Coleman et. al. 1984)
4. Ferguson House (Coleman et. al. 1983)
5. Temple Cabin
6. Ogle House

It is tentatively hypothesized that these six sites can be classified as, and can

provide data on, all of the settlement types discussed earlier. Proposed settlement type assignments are as follows:

1. Wilmington Blvd. (three phases)

   Frontier Town, 1630-1730

   Mercantile City, 1730-1835

   Industrial City, 1835-1900

2. Rt. 4 Schoolhouse

   This site does not appear to fit any of the settlement types and may need to be considered a specific type of site, i.e., rural education, which may exhibit its own particular locational patterns.

3. Wilson-Slack House

   Hamlet, 1840-ca. 1900

   (blacksmithy, wheelwright, railroad station, pre-1850 schoolhouse)

4. Ferguson House

   Homestead, ca. 1800-present

   (agricultural, poultry)

5. Temple Cabin (Ogle's "Red House")

   Homestead in a Village (Ogletown)

6. Ogle House

   Homestead in a Village (Ogletown)

In addition, historical information on Newark and other settlements such as Christiana, Stanton, Ogletown, New Castle, and Glasgow will be utilized to elucidate more completely the development of settlements and settlement patterning through time.

C. Artifact Distributions

A basic archaeological assumption that governs the majority of

archaeological research and analysis is that since human behavior is not random, the archaeological record will exhibit non-random patterns reflecting that behavior. Thus patterns at one type of site may or may not differ from those at another site, and research models provide explanatory means of comparison.

The following factors affect the distribution (or diffusion) of artifacts on a regional level (Hodder 1977:278-291), and are very similar to those discussed as affecting settlement patterning:

1. Friction effect of distance (as distance increases, the frequency of occurrence decreases)
2. Geography (avenues for or barriers to movement)
3. Social and economic (i.e., perceived and actual) value
4. Locations and sizes of competing markets
5. Settlement pattern (in terms of opportunities for interaction via transport network)
6. Degree of receptivity to a new item or idea (Dunnell 1970:316)
7. Time

Therefore, distributions of various classes of artifacts marketed during different time periods can be used to test changes in interaction between settlements in terms of trade patterns and to compare the development of different settlement types. Various researchers have found that quality and quantity of specific artifact types vary according to social status (e.g., Otto 1975; Cressey 1980). Artifact distribution patterns can thus be used to compare status differences within and between settlement types.

Two statistical measures can be used to test interaction between settlements for both the location model and the settlement development model. The first of these is the nearest neighbor statistic, which determines the degree a settlement pattern deviates from random (see Earle 1976). Although this is a descriptive statistic only, it has a high degree of objectivity. Swedlund (1975) used nearest neighbor analysis productively in testing Hudson's (1969) location model. The second statistic that could be employed is the gravity model, which states that "the amount of interaction between two communities is directly proportional to their populations and inversely proportional to the distance between them" (Plog 1976:256). Plog (1976) used this model successfully in his Mesoamerica study, but notes that since its explanatory value is very low, other models should be employed as well (Plog 1976:257). There are difficulties with both of these analytical procedures (Earle 1976; Plog 1976; Crumley 1979), but they have been shown to have utility if the proper precautions are taken.

CONCLUSION

A developing historic research design has been prepared for the Delaware DOT cultural resource projects which can be applied to the Delmarva Peninsula region as a whole. The research design is sufficiently general that data previously obtained, plus that to be acquired in the future, under varying research orientations can be utilized. In addition, the research design framework permits generalized predictions to be made about site location relative to DelDOT's prime function - transportation. Little research has been undertaken in historical archaeology on historic settlement patterning and settlement devleopment through time. It is hoped that the application of this research design in Delaware will contribute significantly to historical archaeological knowledge.